We claim:

1. A method for preparing a quantum state as an input to a quantum computer computation, said method comprising:

preparing a quantum state as an input to a quantum computer computation, wherein said preparing a quantum state includes performing a Hadamard transformation on at least one qubit.

2. A method for computing an approximation of a vector, comprising:

storing a first approximation in a quantum computer register; and

appending a qubit to the register.

3. The method as recited in Claim 2, further comprising:

performing a Hadamard transformation on the appended qubit.

4. A method for preparing the initial state of a quantum computer, comprising:

preparing the initial state of a quantum computer, wherein said preparation includes performing a Hadamard transformation.

5. The method as recited in Claim 4, wherein said preparation further includes:

storing a vector in a quantum computer register; and

appending at least two qubits to the vector.

6. The method as recited in Claim 5, wherein:

at least two of the appended qubits are in the state $|0\rangle$.

7. The method as recited in Claim 6, wherein:

the Hadamard transformation is performed on the appended qubits.

8. A method for efficiently preparing the initial state of a quantum computer required by the quantum method for eigenvalue approximation of Abrams and Lloyd, said method comprising the steps of:

storing a first eigenvector approximation in a quantum computer register;

appending at least two qubits in the state $|0\rangle$ to the first eigenvector approximation; and

performing a Hadamard transformation on the appended qubits.

9. A method for efficiently preparing an initial state of a quantum computer for eigenvalue approximation, comprising:

obtaining a first eigenvector;

placing the eigenvector in a quantum computer register;

appending at least two qubits to the register; and

performing a Hadamard transformation on each of the at least two qubits.

10. The method as recited in Claim 9, wherein the at least two qubits are in the state $|0\rangle$.

11. The method as recited in Claim 10, wherein said first eigenvector approximation is obtained for an eigenproblem discretized on a coarse grid.

12. The method as recited in Claim 11, further comprising using the qubit register after the Hadamard transformation as input to the Abrams and Lloyd quantum method.

13. A method for approximating an eigenvalue of an eigenproblem with a quantum computer, comprising:

obtaining a first eigenvector from a course discretization of the eigenproblem;

storing the first eigenvector in a quantum register of size log N_0 qubits;

appending at least two qubits in a second quantum register to the first eigenvector, wherein the at least two qubits are in the state $|0\rangle$;

performing a Hadamard transformation on each of the at least two qubits to derive a second eigenvector; and

using the second eigenvector in the Abrams and Lloyd quantum method.

14. The method as recited in Claim 13, wherein the first eigenvector is obtained classically.

15. A quantum computing system for computing an eigenvalue, comprising: means for storing a first eigenvector in a quantum register;

means for appending at least two qubits to the first eigenvector in the quantum register; and

means for performing a Hadamard transformation on each of the at least two qubits.

16. A quantum computing system as recited in Claim 15, wherein said additional qubits are appended while in a predetermined state.

17. A quantum computing system as recited in Claim 16, wherein the predetermined state is the state $|0\rangle$.

18. A quantum computing system, comprising:

a first quantum register with size of at least log N_0 qubits, able to store an eigenvector;

means for appending at least two qubits in a second quantum register, each of the at least two qubits in the state $|0\rangle$, to the eigenvector; and

means for performing a Hadamard transformation on each of the at least two qubits.

19. The quantum computing system as recited in Claim 18, wherein:

the eigenvector is derived from an eigenproblem discretized on a coarse grid.

20. The quantum computing system as recited in Claim 19, further comprising:

means to use the eigenvector as input to the Abrams and Lloyd quantum method; and

a module stored on magnetic media.